# **Chemical and Biological Analogues**

Working Definition: "Anything biologically inspired, or a chemical outside of the traditional range (ZIFs, MOFs, etc.)"

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## Amino Acids and Peptide Salts for CO<sub>2</sub> Removal

Stage of Development:
Applied Science

Actual Power Plant /
Ability to bio-manufacture on the necessary scale
Pilot Scale Test
No data on scaling parameters: durability, yield, capacity, etc.
System Engineering /  Need to design for adsorption and regeneration
Engineering Science
Lack of performance data
Applied Science
Peptides are unstable at certain temperatures  Basic Science

## **Carbonic Anhydrase Memetics**

Actual Power Plant /	
Pilot Scale Test	/
Variable nature of flue gas	
Lack of scale up parameters	
System Engineering /	
System compatibility	
Engineering Science	
No knowledge of physical behavior for many materials  Applied Science	
No model or screen to predict catalytic activity  Flue gas poisoning	
Basic Science/	
	/

## Algae for CO<sub>2</sub> Capture

Stage of Development:
Pilot Scale Test

Actual Power Plant /Lack of combustion operating  Nutrient integration	experience with biomass
Pilot Scale Test	/
System Engineering /	
Engineering Science	
Applied Science	
Toxicology and purification questions  Photo-inhibition and carbon capacity	
Basic Science/	/

# Develop a Biological Analogue for the Production of Oxygen on a Large Scale for Oxy-combustion

Actual Power Plant	/
Pilot Scale Test	
System Engineering /	
Engineering Science	
Applied Science	
Finding a suitable material!	
Basic Science	/

#### **Process Steam Conversion of Flyash to Carbonation Materials**

Actual Power Plant /
No lifecycle assessment of the process
Pilot Scale Test
Coordination needs to minimize system downtime
System Engineering //
No understanding of the impact of the power plant lifecycle on dynamics
Engineering Science
Lack of understanding of fluid dynamics in a reactor environment
Applied Science
Insufficient understanding of key variables
Basic Science

## **Develop Bio-Inspired Synthetic Catalysts to Capture CO<sub>2</sub>**

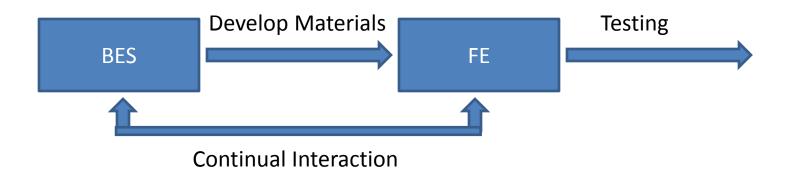
Actual Power Plant/	
Pilot Scale Test	
System Engineering /	
Engineering Science	
Applied Science	/
Find a suitable material!	
Basic Science	/

# **Common Themes**

- Ideas toward the Basic Science side
  - Common tool requirements
- Benefits of predictive modeling
  - Discovery of entirely new materials
- Important processes occur at interfaces
- Communities which are not traditionally involved with energy
- Difficulties in scaling up
- Intellectual property

# FE/BES Collaboration Opportunities

- Catalytic behavior
- Knowledge Transfer
- Tools to access and organize information
- Transition from micro- to macro-scale



# Questions?